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DEVELOPMENT AND IMPLEMENTATION OF COMPUTERIZED MANAGED MAINTENANCE SYSTEMS -VOEST-ALPINE EXPERIENCE **

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*** VOEST-ALPINE Industrial Services, Austria

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1. VOEST-ALPINE

The VOEST-ALPINE concern is fully owned by the Österreichische Industrieverwaltungs-Aktiengesellschaft, which is owned by the Federal Republic of Austria.

Organisation and Areas of Activity

VOEST-ALPINE is structured into 9 divisions (4 central and 5 production) and has approximately 60 affiliated companies in Austria and 80 affiliated companies outside of Austria.

Division	Areas of Activity
General	General Secretariat, Central Marketing, Trading and Wholesales
Finance	Treasury, Controlling
Administration	Personnel, General Administration and Procurement
Mining and Research	Mining (iron ore, coal, wolfram), Provision of raw material, Research and Development, Quality Control
Metallurgy	Flat and non-flat rolled steel products

Division	Areas of Activity
Processing	Foundry, forged products, tubes and pipes, wire, rope, cold processed profiles, tools, movie cameras
Finished Products	Machinery for mining, workshops, industrial robots, Transport equipment; vessels, cranes, rails, buildings, compost plants turbines, heat exchangers, tanks, pipelines, boilers, components for nuclear power plants
Engineering & Contracting	Metallurgical plants, chemical plants, food processing plants, clinics and hospitals, training, technical and management assistance, energy conservation
Electronics & Automation	Process control systems, microprocessors, boards for integrated circuits, commercial and technical software, computer components

Statistical Data 1983

Turnover:	in bill. Austrian Sch.
Metallurgy	26.3
Processing	10.3
Finished Products	13.4
Plants and Services	22.9
Trading	46.3
Total:	119.2

Employees:	
Worldwide	72,288
Austria	67,677
Mother Company	39,179
Affiliated Companies	28,498

2. METALLURGICAL PLANT

2.1 Metallurgical Plant - Linz

Plant Type	Plant Description	Capacity/year	Eng.
Coke Oven	8 Blocks	1,732,000	Otto, Didier, Still
Sinter Plant	5 Sintering strands	4,400,000	
Blast Furnace	1 x 7m hearth diameter	465,750	
	3 x 8m hearth diameter	603,750	
	1 x 11m hearth diameter	1,836,000	VA
LD Plant	2 x 52t	1,396,000	VA
	2 x 130t	1,545,000	VA
Continuous Casting	2 x for slabs (LD2)	1,200,000	VA
	2 x for slabs (LD3)	1,500,000	VA
Electric Arc Furnace	2 x 20t	75,300	
Heavy Plate Mill	Four high stand	650,000	Möller Neumann Krupp
Hot Strip Mill	1 Roughing Stand 7 Finishing Stands	2,490,000	Demag Mesta VA
Cold Rolling Mill	1 Four high reversing Mill		VA
	1 Four high reversing Mill	517,500	VA
	1 Sendzimir Mill (Z Mill)		VA
	1 Tandem Cold Mill	802,500	VA

Plant Type	Plant Description	Capacity/year	Eng.
Hot Strip Galvanising		141,400	Heurty
Foundry	Steel castings 3 - 70t (100 t max)	7,000	
Forging	Hammer forge Drop forge Sheet Steel press	32,000	

2.2 Metallurgical Plant - Donawitz

Plant Type	Plant Description	Capacity/year	Eng.
Sinter Plant	1 Sintering strand	1,430,000	VA
Blast Furnace	1 x 8m hearth diameter 1 x 7m hearth diameter	1,200,000	
LD Plant	3 x 60t	1,300,000	VA
Continuous Casting	1 Billet caster with 6 strands	380,000	VA
	1 Bloom caster with 3 strands	480,000	VA
Ingot & Slabs Mill	1 x 2 high reversing stand	465,000	
Billet Mill	Blooming Train 2 x 2 high stands Finishing Mill 6 x 2 high stands	316,000	
Section Mill	1 x 2 high reversing stand	108,000	
Section Finishing Mill	3 x 3 high stands 1 x 2 high finishing stand or a universal stand	219,000	
Bar Mill	9 Roughing stands 4 intermediate stands 4 finishing stands	175,000	
Wire Rod Mill	8 stand blooming train 2 x 10 intermediate stands 2 x 10 finishing stands	515,000	VA

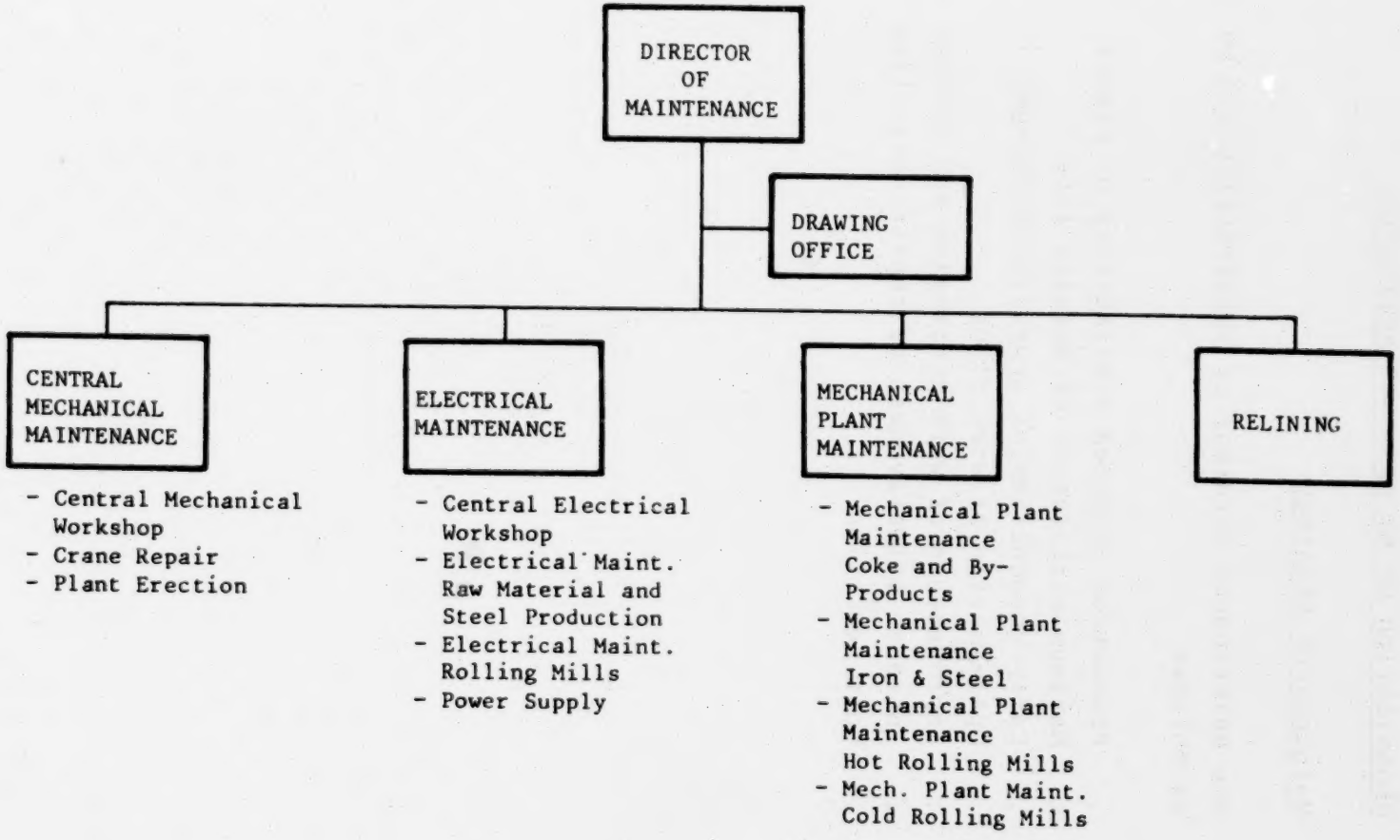
3. ORGANISATION OF MAINTENANCE ACTIVITIES

3.1 Maintenance Strategy

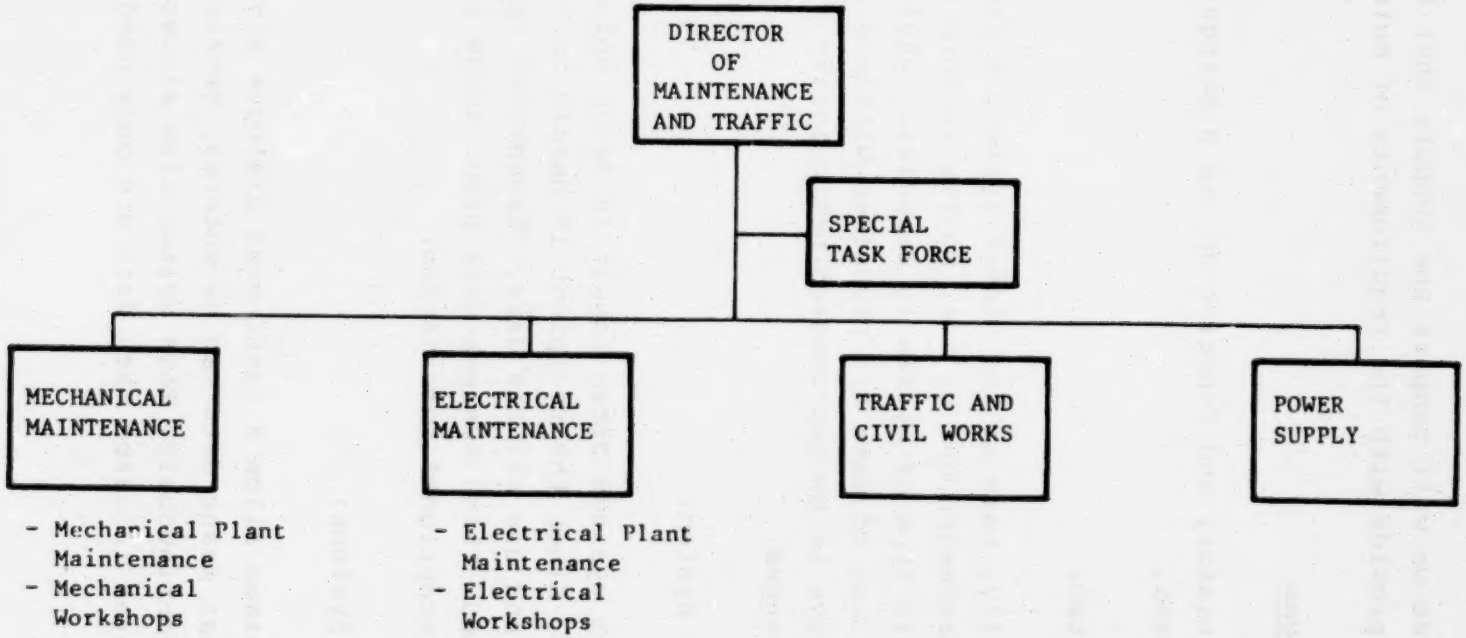
The maintenance strategy of VOEST-ALPINE can be summarised as follows:

- Production oriented availability of plants
- Maximum utilisation of service life
- Early recognition of approaching damages
- Optimisation of work plans
- Improvements of work monitoring and control
- Increase effectiveness of repair activities
- Cost reduction

3.1 Functions of Maintenance and their Organisation in the Linz Works


DIRECTOR OF MAINTENANCE
DRAWING OFFICE
CENTRAL MECHANICAL MAINTENANCE
- Central Mechanical Workshop
- Crane Repair
- Plant Erection
ELECTRICAL MAINTENANCE
- Central Electrical Workshop
- Electrical Maint. Raw Material and Steel Production
- Electrical Maint. Rolling Mills
- Power Supply
MECHANICAL PLANT MAINTENANCE
- Mechanical Plant Maintenance Coke and By-Products
- Mechanical Plant Maintenance Iron & Steel
- Mechanical Plant Maintenance Hot Rolling Mills
- Mech. Plant Maint. Cold Rolling Mills
RELINING

3.2 Functions of Maintenance and their Organisation in the Donawitz Works



4. AUTOMATION ACTIVITIES IN MAINTENANCE

In this chapter we will compare the support that EDP can economically provide with the requirements of maintenance.

Types of Systems

According to history and function we can distinguish various types of systems.

- Batch System:

  Historically, this is the oldest system. A large bulk of data is processed one by one, mostly in form of punch cards. This type of system is especially useful when large volumes of data are processed within a short time or data have to be reprocessed periodically with only slight changes.

- Exception System:

  Pure batch systems often result in large volumes of printouts. Since the recipient is hardly in a position to check and use all the data, "Exception" systems were implemented. These systems only print those lines which contain exceptional information.

- Dialogue Systems:

  These systems allow a continuous dialogue with the computer, that means data can be entered, retrieved and updated continuously. This system also allows the use of the computer in cases when data are only used a few

times. With this type of system new areas of applications were feasible.

- Analysis Systems:

  These systems allow the use of computer as a real tool to support decisions. Data available from applications are analysed, are used to simulate specific situations.

- Office Automation Systems:

  Here in the history of data processing it is no longer the data which are the centre of concern. The computerisation of all bureaucratic procedures is subject to the objective of the office computerisation. Therefore new fields are conquered by the computer which were previously closed to computers for economic reasons.

Functions in Maintenance and the Aptitude for Computerisation

Basically we can distinguish between three major functions in maintenance.

- Central Maintenance Workshop
- Plant Maintenance
- Spare Parts Management

Further on we will analyse these three functions to find out if they can be computerised and what type of systems might be appropriate for them.

- Central Maintenance Workshop

This function can be broken into the following subfunctions.

- Order Handling
- Job Preparation
- Scheduling
- Shopfloor Control
- Cost Control

One of the earliest areas of application in Central Maintenance Workshop was Cost Control. Of course these systems were batch systems. Their main objectives were to provide information on life-cycle costs of equipment. Other areas of application, which also started in the batch area, were scheduling. However, customers were not very pleased with batch scheduling systems, since their schedule algorithm was so strict that the computer calculated results which did not really meet customer's expectations. So only the recent possibility of implementing dialogue systems allowed an integrated solution of all functions of the Central Maintenance Workshop, providing the flexibility especially in scheduling expected by the user. So applications in the Central Maintenance Workshop are not too frequently found and we will be glad to be able to present you our solution a little bit later.

- Plant Maintenance

We are sure that by this stage of the meeting we will repeat certain facts which have already been discussed. However, to be able to analyse the usage of computers in plant maintenance we have to structure the function of plant maintenance. Subfunctions of plant maintenance are

. Servicing
. Inspection
. Repair

Concerning the subfunction Repair we have to distinguish between unplanned repairs, which are the result of a breakdown, and plant repairs which are the result of facts found during inspection. Since no large volume of data is valid for these functions, batch applications were not developed in this area. Forthcoming of dialogue systems now allows the cover of most functions of plant maintenance. However, the so-called unplanned repairs do not even meet the dialogue systems requirements. Unplanned repairs do not allow planning, are always very urgent. So in this area only the future office automation systems might be able to provide advantages.

For planned repairs nearly the same structure of subfunctions which was used above for Central Maintenance Workshop can be applied.

We are also pleased to be able to present you the system we use for planned maintenance.

- Spare Parts Handling

Although the spare parts handling could also be supported by a batch system, only a few implementations of spare part handling systems in batch were carried out in the batch area. The reason probably is that, in those days spare parts handling had no priority since a special feature of spare parts is that they belong to the slowest moving stocks. So data processing departments and users concentrated on the

fast moving consumables. In addition, requirements planning for consumables is much easier than for spare parts.

With the forthcoming of dialogue systems efforts concentrated mainly on implementing spare parts handling systems. Of course, VOEST-ALPINE also has a computerised spare parts handling system. Since it would overrun the available time, we are not going to speak in more detail about the spare part handling system.

In this chapter we only covered the computerisation of functions and subfunctions and not the possibilities of computerising single tasks. Such tasks like calculation of times, material requirements, etc. can also be computerised. Since also here the variety of possible computerisation would overrun the available time we refrain from touching it in more detail. In addition, EDP applications to computerise these tasks are hardly economic.

5. EXAMPLE: COMPUTERISED PLANNING AND CONTROL SYSTEM FOR CENTRAL MAINTENANCE WORKSHOP IN DONAWITZ WORKS

5.1 Volume of Activities

Productive hours per month: 45,000
Number of machines: 80
Number of non-mechanised working places: 210
Average number of active orders: 1,500
Total of order per year: 10,500
Number of operations per month: 4,500 - 6,000

5.2 Objective of the Project

The Project Team responsible for the execution of the computerisation of the planning and control in the Central Maintenance Workshop had to pursue the following objectives:

- Improvement of procedures and organisation structure in the Job Preparation Sector and on the Shopfloor aiming at an efficient treatment of orders, a proper functioning of scheduling and keeping deadlines.

- Inclusion of all orders in the Planning and Control System whereas the chosen software package should also be capable of supporting external orders.

5.3 The Situation at Project Start

At the time when the project started, 22 senior foremen controlled the Central Maintenance Workshop operation. No central scheduling or shopfloor control was available. No order handling was installed and the preparation of job cards was not frequently done. Planned times for each

operation were neither calculated nor estimated. The Central Maintenance Workshop operation relied strongly on the effectiveness of the cooperation of the 22 senior foremen. Therefore, no information was available about the present workload and obtainable target dates for the completion of the orders.

5.4 The Standard Software Package PS

Since it is company policy to use standard software packages whenever possible, we analysed available standard software packages for Production Planning and Control. This evaluation showed that the PS- System was best suited for this purpose, since it was the only package which supported make-to-order productions types. It is also the only system which allows implementation with incomplete data and data structures. The PS system is a modular system comprising all functions necessary to control operations.

From the modules of the PS System the following sub-modules were selected for implementation:

- Order Handling
- Bill of Material Processing
- Preparation of Job Plans
- Preparation of Shopfloor documents
- Assignment of work to each unit of the Shopfloor
- Shopfloor control and production data recording
- Cost Control

5.5 Functions of the System

For the purpose of easy system implementation we divided the system into 5 subsystems. In the following we describe the subsystems and provide some examples of VDU screen layouts and printouts.

- Subsystem "Order Handling":

  In this subsystem all orders received by the Central Maintenance Workshop are entered into the computer. The work to be performed following the orders can be distinguished as repair work, manufacturing of spare parts, the manufacturing of parts in extension and rehabilitation projects or manufacturing orders from external customers. Priorities can be assigned to each order.

- Subsystem "Job Preparation":

  This subsystem contains two major functions: Bill of Material Processing and Preparation of Job Plans. Once the Job Planner receives the Customer Order he checks if the necessary Bill of Material or Job Plan is already available in the system. This can be done either by checking according to the Job Plan number or the number of the drawing where the part or the assembly is contained. If he finds the Bill of Material or Job Plan he checks whether these documents can be used as they are or whether they have to be changed. If changes are necessary he can copy the Job Plan and make the necessary modifications. If the necessary Bill of Material or Job Plan is not available in the computer, the Job Planner

can enter the necessary data into the computer.

- Subsystem "Scheduling":

  The Job Scheduler receives information about each prepared Job Plan. He then schedules the Job Plan taking into consideration various facts such as priority, requested delivery date, available capacity, etc. The system thereby supports his decision with information which he can retrieve in a dialogue with the computer. After scheduling the Job Plan, the shopfloor documents are printed. A special feature in our printing of shopfloor documents is the printing of bar codes, which allow the entering of feedback information on the shopfloor using a barcode reader.

  An additional feature in the system is the automatic printing of purchase orders in the case where a certain operation has to be performed outside of the company.

- Subsystem "Shopfloor Control":

  The short term shopfloor control is done by the senior foreman.

  The following status can be reported using the barcode reader:

- Start of a job plan
- Start of an operation
- Completion of an operation
- Completion of a job plan
- Delivery to the customer

5.6 Project Schedule and Installed Hardware

Activity	Date
Decision	January 1983
Installation of Hardware	May 1983
Bill of Material Processing	August 1983
Job Planning	September 1983
Order Handling	October 1983
Scheduling	January 1984
Shop Floor Control	January 1984
Installation of Barcode Reader	April 1984
Start up of Barcoding System	June 1984

Installed Hardware

- DEC VAX11/750VMS

  12 VDUs
  2 Printers
  36 Barcode Readers

5.7 Benefits obtained by Implementing the System

After using the system for a large part of 1984 the following benefits can be assumed:

- Increase of Job Planners productivity

  The Job Planners increased the work they prepared by 100%. This tremendous productivity was partly achieved by reusing existing job plans and partly by simplifying the preparation process.

- Productivity increase of shopfloor personnel

  Compared with the situation before the implementation of the system, the amount of working hours required for the execution of the same order is now 15% lower. This reduction was achieved by improved work preparation, by the better provision of information. This led to a reduction of time required for waiting, being idle and transport.

6. EXAMPLE: COMPUTERISED PLANNED MAINTENANCE SYSTEM AS INSTALLED IN ZISCO, BAYOU AND THE VOEST-ALPINE WORKS, LINZ AND LIEZEN

6.1 Objective of the Project

The objective of all projects was the achievement of a higher plant availability by:

- Guaranteeing the execution of all maintenance activities to ensure a high plant service life

- Increasing the planning part of repairs to ensure

  - higher quality of performance
  - shorter performance times
  - shortest possible interference with production

6.2 Starting Situation

Longer term planning of repairs requires an exact knowledge of the condition of the plant. Thus it is necessary that all as critical defined plant parts are checked regularly. These inspections must be carried out by experts, who know the wear behaviour of the machine parts and their effects.

Furthermore, suitable organisation structures must be created which ensure the transfer of the known development of damage as a basis for the planning and realisation of the necessary measures.

6.2.1 Situation in the VOEST-ALPINE Works

The entire maintenance organisation in the VOEST-ALPINE Works was converted to planned maintenance in the 1960's, i.e.

- inspection units
- work preparation, and
- work control departments

were installed. At that time, due to the increased pressure of costs and the increasing technical complexity, it was no longer possible to place the responsibility for the security of the plants' availability on the experience of individual foreman. With the introduction of work distribution, based on an objective condition report, an exact work preparation could be carried out. The foreman's activities were then reduced to work control and monitoring according to preset plans.

The necessary servicing for guaranteeing the service life was traditionally a function of the plant personnel and is still carried out by plant personnel.

Since the planned maintenance was already carried out in the 1960's by VOEST-ALPINE, the transfer to EDP was carried out without any changes to the organisation. The objective of this transfer was not so much to increase the planning part but more the rationalisation and possibility of obtaining actual reports to improve decisions by the plant management.

6.2.2 Situation - Zimbabwe Iron & Steel Comp., Zimbabwe

Here the situation was marked by the distinctly low plant availability. An analysis showed, that neither maintenance nor repair planning was carried out on the necessary level. No structure and forms nor necessary experts were available. The condition of the entire plant was critical.

During this "operation improvement" project the following activities were undertaken following a step by step plan:

1) Repair of major weakness points of the plants during a "trouble shooting" mission

2) Increase of plant reliability by preparation of servicing instructions and controls
(e.g. drastic reduction in frequency of standstills)

3) Creation of the basis for repair planning by preparation of inspection instructions and deployment of inspectors; improved feedback from plant personnel achieved by introduction of "defect report cards".

4) Parallel to the introduction of servicing, inspection and defect reports, work preparation was installed and equipped with manual planning systems. Work control cards were introduced.

5) In the final phase the manual systems were replaced by a microcomputer supported system. The first area to be computerised was the wire rod mill. The heavy mill is planned as the next area.

6.2.3 Bayou Steel Corp., U.S.A

The project phases correspond to those of ZISCO. However, it must be mentioned that the plant has only been in operation for 2 years and the personnel had longer experience.

The entire operating plants were computerised after an acclimatisation phase with the manual system.

6.3 The Planned Maintenance Software Package

The system was developed for microcomputer. The reasons for this decision were:

- The higher degree of independency of the maintenance departments so that the additional expenditure for large computers had no advantages.
- The simplicity of the installation of this type of systems.
- The strategy to leave the responsibility with the user (my baby!)
- The low investment costs
- The possibility to integrate systems stepwise by means of linking
- The possibility to avoid complex solutions and to establish practical solutions which concentrate on the important issues.

We oriented the design of the programmes and the necessary organisation naturally to the experience of our maintenance departments. In spite of this, we made individual adaptations to client's requirements.

The package comprises the following standardised functions:

- Servicing
- Inspection
- Job Preparation
- Reports

Optionally, individual systems can contain the following functions:

- Preparation of orders for Central Workshops
- Spare part ordering of non-stock spares
- Capacity planning - personnel

The degree of detail of the individual functions also varies.

6.4 Functions of the System

- Subsystem "Servicing"

  This function records all periodic greasing jobs and determines the corresponding times.

  The feedback of the execution of the servicing is recorded in the system. For jobs not reported reminders are printed automatically.

Job cards are not printed for work carried out daily. This work is contained in lists which remain by the servicing personnel. The execution of this type of work is recorded for control purposes only.

It is recommendable to identify jobs especially which can be carried out during plant standstills. This allows the execution of such servicing during sudden plant standstills.

- Subsystem "Inspection"

This system is similar to the servicing subsystem. The instructions can be freely formed, however short standard formulations should be aimed at. Furthermore, statements regarding necessary tools, measuring devices and damage limits can be stored. Inspection cards with a feedback column can be printed, in which all results can be entered.

It is important to mention here, that the planning efficiency is decisively influenced by the inspection quality.

In many countries it is a problem to provide really good inspectors. These inspectors, as well as the Job preparers, should be experienced maintenance men. Resistance exists in many plants, when one tries to deploy well qualified maintenance personnel for these activities. Not only once we experienced that such personnel was used again for repair activities during the first major repair. This consequently resulted in a return to "trouble shooting" and a rapid deterioration of the availability.

- Subsystem "Job Preparation"

  In this system job cards are prepared based on inspections or damage reports. The degree of detail of this preparation fluctuates considerably. In the system in VOEST-ALPINE Linz the so-called repetitive repairs can be retrieved automatically. That means reference can be made to previous preparations, so the work involved is considerably reduced and the planning accuracy increases.

  Detailed repair instructions should never be stored because of the high costs involved.

  Required personnel should be stored according to trades and necessary spare parts included. Instead of a detailed work description only the work plan number and drawing numbers should be stored.

  Studies have shown how important accurate job preparation is and that up to 50% of the working time of maintenance personnel is unproductive. The reasons being lack of resources like tools, spares.

- Subsystem "Reports"

  a) Weakness Point Analyses

  Investigations by the TÜV have shown, that up to 50% of the total maintenance costs can be attributed to errors on the part of the manufacturer.

For diagnosis of weak parts, two different methods are distinguished:

1) By defining down the target service life:
   This method can show the weak points most precisely. A precondition for this is, of course, a realistic forecast of service life which production requirements takes into account (e.g. no excessive service life necessary, if parts can be changed easily during inevitable interruptions).

2) By defining down maximum frequency of damage:
   If insufficient information is available about the planned service life, the weak points have to be diagnosed from the frequency of failures. The problem here, of course, is that although a high frequency of failures is registered, the effects on production can, however, be minimal. Such plant components can not be designated as weak points, as the expenditure in reducing the frequency of failure probably does not give corresponding economical advantages.

   To be able to define weak points properly requires that the corresponding results of the damages (repair costs, down time) must also be registered.

Consequently, after defining weak points, the causes of damages have to be investigated. For this a detailed history of the effected elements must be available. Recommended alterations can concern the change of intervals of periodic instruction as well as alterations in construction.

6.5 Project Schedules and Hardware

ZISCO

1)	Decision to install PM system	11.83
2)	Analysis	12.83
3)	Software Adaptation	3.84
4)	System's installation (Delay of hardware delivery)	6.84
5)	Data Preparation	10.84
6)	Data Input	12.84
7)	Start of Operation	1.85

Hardware: WANG PC
Printer
Harddisc 15MB

BAYOU

1)	Decision to install PM system	6.83
2)	Start of manual system Rolling Mill	9.83
3)	Installation of computerised systems for the whole plant	9.84

Hardware: 2 Radio Shack TANDY Model 12
2 Line printers
2 Harddisc 12MB

VOEST-ALPINE - LIEZEN

1)	Decision to install computerised PM system	6.84
2)	Installation and Data Preparation	10.84
3)	Start of Operation	11.84

Hardware: HP-150
Harddisc 20MB
Printer

6.6 Benefits obtained by Implementing the Systems

Parameters for the economical assessment of the efficiency of maintenance plants are extremely problematic. As an example only the indicator of specific maintenance costs is quoted.

$$\text{Specific maintenance costs} = \frac{\$ \text{ Maintenance expenditure}}{\text{t Production}}$$

This indicator is influenced not only by the productivity during the service times but also by the maintenance economy. It can show a completely false picture of the actual situation.

At best the efficiency (not the economy!) can be shown on the basis of the plant availability.

However, one major problem is that causes of standstills as well as production errors are very often taken into consideration in the plant availability - so this picture is distorted.

6.7 Futural Aspects

6.7.1 Computerised Condition Monitoring Systems

A new development are computerised monitoring systems that are directly connected with the process equipment and steadily compare their measuring results with fixed damage limits. They are the inspection systems of the future.

These systems can be installed in existing plants, but due to the actual high costs they should be only used for most critical parts and points that can not be inspected with normal technology. We think that in future approximately 20% of the equipment will be monitored by omputerised systems.

As a step between normal inspection technology and fully computerised system, portable inspection equipment for analysing of temperatures, pressures, vibration, etc. have been introduced. This equipment is pre-programmed for its daily work by microcomputers and will play a decisive role in future.

Advantages of the system:

- reduced qualification of inspection personnel necessary
- subjective influences on the evaluation of feedback are reduced
- through trend analyses the development of damages can easily be forecasted
- through comparison of failure patterns with existing patterns the causes can be defined more detailed

- also very fast developing damages are timely reported

6.7.2 Maintenance Performance Measuring Systems

Today, availability analyses, time analyses, etc. are available to the maintenance managers. These evaluations, however, are not able

- to show a transparent picture of maintenance activities, which leads to much uncertainty about the necessity of the present level of effort for maintenance and the costs involved.

- to identify the real problems and their causes, so that many management decisions such as:

  . changes in the organisation
  . reduction or increase in staff
  . stock level reduction or increase
  . equipment of the maintenance shops, etc.

  are taken by instinct. It is also impossible in restrospect to check clearly the correctness of the decisions taken.

This problem of an unclear decision base is not new and not limited to maintenance organisations. Previously in the 1960's, performance measuring systems were developed which enabled the identification of factors influencing production and to vary these factors correspondingly.

A similar model for use in maintenance organisations has been developed at the University of Leoben, Austria.

About 50 parameters were defined and combined, so that statements on various situation of the maintenance department can be formulated.

How can this maintenance performance measuring system (MPMS) be applied?

If maintenance has to solve a problem, it can use the MPMS to find the parameters causing the problem and take the appropriate measurements. These measurements however, correspond now to the alteration of the one or more parameters (e.g. the alteration of the number of employees). The effect of this alteration on other parameters can now be simulated by the system. This simulation has the impact of the variation on other parameters.

If the computer supported system of the job planning section, which already possesses a large amount of necessary information, is now connected with MPMS on a second micro, a control instrument is obtained capable of making a large number of statements, that go far beyond the current management information.

What can such a report function offer?

A) All classical information of management information systems like:

- Immediate presentation of cost and time developments with an analysis of trends.
- Extensive support in preliminary preparation
- Precise graphic presentation of data for senior management
- Reduction in the manual, time-consuming preparation of topical reports and statements

B) Continuous control over deviations from targets and the ability for early correction.

C) Simulation of decisions and their results which should lead to much more proven decisions of management.

As there is still much potential for rationalisation also in our plants, the transfer of this management information and simulation model into a computer aided system has been given preference. In future we think that this system will become a second step of improvement in those client's plant, who already have installed well functioning planned maintenance.

6.7.3 Microcomputer Networks

The new generations of microcomputers offer the opportunity to link computers to one another. This offers the chance, to build up an integrated system step by step.

Especially a link to the warehouse system is very important. If the required spares are not available the whole process of job preparation cannot meet the objectives.

7. VOEST-ALPINE INDUSTRIAL SERVICES AND THE IMPORTANCE OF MAINTENANCE

The Business Objective of VAIS

VOEST-ALPINE, beyond being a producer of steel also engineers, supplies, erects and starts up metallurgical and chemical plants. In the early 70's VOEST-ALPINE was confronted with customers in the developing world who were not able to operate and maintain their new plants fully right from the point where they took over the turnkey plants. Besides the turnkey plants, this new type of customer required separate services which would enable them to operate and maintain the plant themselves. These services are

- Training of operation, maintenance and administration personnel
- Technical Assistance to operation and maintenance personnel
- Organisation structure and systems to operate, maintain and administrate the plant.

Since a well operated plant is a better reputation for us being a plant builder, and since we are also a plant operator we are able to provide these services. To provide these services effectively, an affiliated company, VOEST-ALPINE Industrial Services, was founded.

Clients problem with maintenance

Basically we distinguish between two types of clients in developing countries

- Clients whose major objective is to reach the rated capacity
- Clients whose major problem are in the cost of production

For the first type of client the identification and provision of spare parts is generally a great problem immediately followed by maintenance problems. Computerised planned maintenance can help to avoid unnecessary standstills and repairs which, due to lack of experience of the client's personnel, take a rather long time.

The second type of client has to reduce costs by increasing the productivity of his manpower. Computerisation in the Central Maintenance Workshop and Planned Maintenance can bring considerable cost reductions. This cost reduction is achieved by better utilisation of the employees' capacity, by increasing the life cycle of the equipment and by reduction of spare part costs.